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Visual acuity and adaptation to optical defocus

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Blur adaptation

Improvement in visual resolution after exposure to defocus,

which is unaccompanied by a change in:

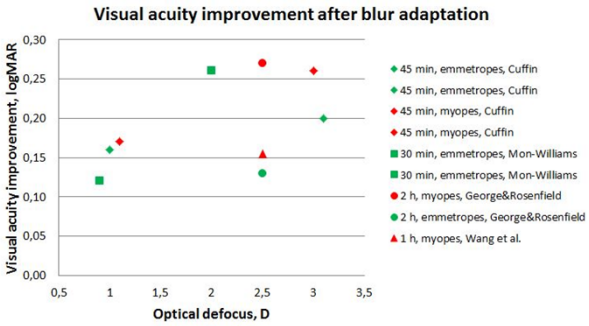
Accommodation → refractive error

Depth of focus → pupil size,

palpebral aperture size.

Parameters in blur adaption studies

- Refractive group – myopes, emmetropes ……
- Defocus level +1,0 D, +2,0 D, +3,0 D ……
- Adaptation time – 30 min, 1 h, 2 h ……



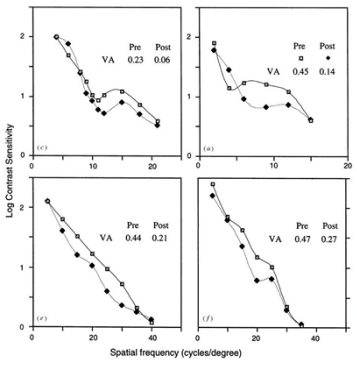
What changes?

- **Active neurophysiological compensatory process** (binocular sites, visual cortex)

- Recalibration of perceived contrast
- Relative contrast constancy mechanisms

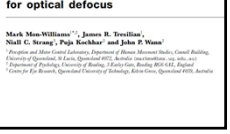
That is, the relative gains of visual channels that respond selectively to different spatial frequency bands are assumed to be dynamic and adjustable to provide final-stage perceptual constancy of the retinal- image spatial spectrum.

Contrast sensitivity



Decrease in mid-range (5-25 cpd)

After adaptation to +2,0 D 30 min


Improving vision: neural compensation for optical defocus

Mark Mon-Williams[1,2], James R. Tresilian[1], Niall G. Strang[1], Puja Kochhar[1] and John P. Wann[1]

What changes?

- The enhancement of blur sensitivity (e.g., the decrease in depth-of-focus) may in part be attributed to the increase in visual resolution present after blur adaptation. (Wang et al. 2006)

Blur adaptation:

↓ Blur sensitivity threshold ↑ Blur sensitivity ↓ DOF

Blur adaption vs. Depth of focus

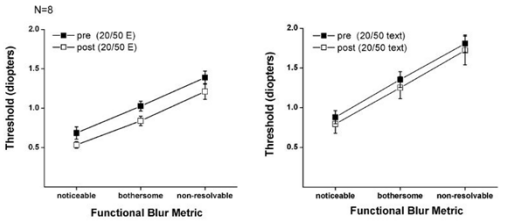


Fig. 2. Pre- and post-adaptation blur thresholds as a function of blur criterion for the two test targets. Plotted is the mean ±1 SEM.

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Effect of blur adaptation on blur sensitivity in myopes

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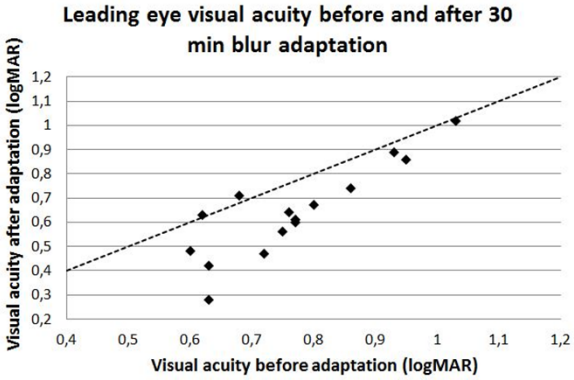
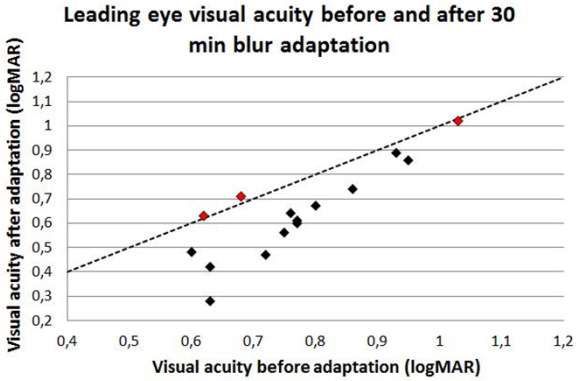
Experiment

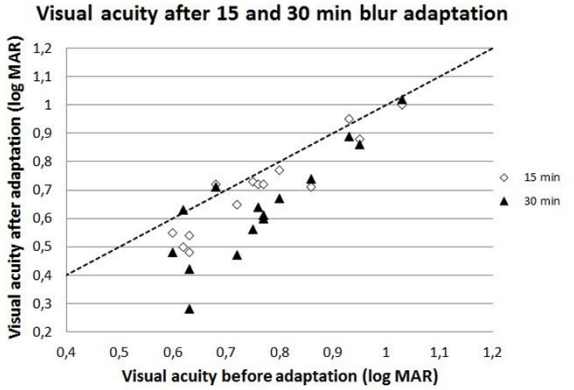
- Blur adaption time 15 min, 30 min
- Defocus level +2,0 D
- N= 15 (age 22 ± 2)
  refraction from +1,5 to -5,5 D

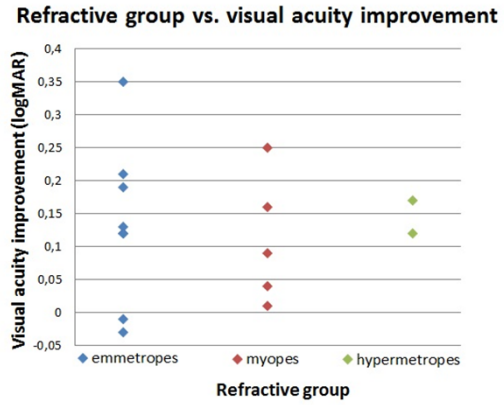


Avg. Improvement 0,17 ± 0,08



Avg. Improvement 0,16 ± 0,06





Future plans

- Use direct measurements of blur adaptation:

  Indirect – visual acuity measurements

  Direct – blur sensitivity measurements
- Optical defocus adaption vs. Computerized blur adaption

Thank you for your attention!

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